

Appl. No. : 09/945065
Filed : August 30, 2001

REMARKS

With this amendment, Claims 1-4, 6, 8-9, 12, 14-17, and 19-20 are pending in the present application. Claims 1, 8, 12, and 14 have been amended. Claims 7, 10, 11, and 18 have been canceled. In view of the foregoing amendment and the following remarks, Applicant respectfully requests reconsideration and allowance of this application.

Examiner Interview

Applicant would like to thank the Examiner for the courtesies extended to Applicant and Applicant's representative, Michael H. Trenholm, during the personal interview of July 10, 2003. As discussed at the Interview, Applicant is presenting claim amendments in accordance with the proposed claims presented at the interview that Applicant believes should overcome the prior art of record. Further discussion of the Examiner's rejections is presented below.

Claim Rejections-35 U.S.C. §103(a)

The Examiner rejected Claims 1-4 and 6-20 under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,404,058 to Taguwa in view of U.S. Patent No. 6,262,485 to Thankur et al. Taguwa discloses using titanium silicide to improve the adhesion between titanium and titanium nitride. Thankur shows implanting titanium in a silicon substrate forming a titanium silicide refractory metal layer. However, the references do not teach or suggest, individually or in combination, the concept of utilizing a thin layer of titanium silicide, less than about 150 Angstroms, as *both* an adhesion layer and a refractory metal silicide material.

One embodiment of Applicant's invention is directed toward a contact structure having a metal silicide layer formed in a manner so as to improve Ti/TiN adhesion on the side wall of the contact opening while at the same time serve as a refractory metal silicide layer in the bottom of the contact opening. Use of the same metal silicide layer to serve both of these purposes reduces the layers of material deposited in the contact opening, which in turn is particularly beneficial for small-diameter, high aspect ratio contact structures.

While Taguwa discloses the formation of a $TiSi_x$ layer between Ti and TiN, the $TiSi_x$ layer is about 10 – 20 nanometers thick, which is about 100-200 Angstroms. (See, e.g., Column 5, Lines 20-21 of Taguwa) Thus, if the first Ti layer 104 of Taguwa is implanted into the silicon substrate as taught by Thankur, the combined $TiSi_x$ refractory metal silicide layer formed in the bottom of the contact structure would be at least 200 Angstroms thick as the Ti layer of Taguwa

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is about 100 Angstroms (10 nanometers) thick. (See, e.g., Column 5, Lines 1-2) While the thickness of each layer is arguably a design choice, Applicant submits that the claimed contact structure is advantageous because it reduces the amount of metal (titanium) that needs to be initially deposited to form the refractory metal silicide because it utilizes the subsequently deposited metal silicide adhesion layer as a part of the refractory metal layer. Accordingly, Applicant respectfully requests that the rejection of the claims over these references be withdrawn.

CONCLUSION

In view of the foregoing, Applicant respectfully submits that all pending claims of the present application are in condition for allowance, and such action is earnestly solicited. Should there be any impediment to the prompt allowance of this application that could be resolved through a telephone conference, the Examiner is respectfully requested to call the undersigned at the number shown below. Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Respectfully submitted,

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Dated: 7/21/2003

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